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A longitudinal study of physical activity and personality in the wellbeing of older adults

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Objective: This study examines the interactions of physical activity and personality traits in the subjective wellbeing (SWB) of older adults.

Methods: 520 Scottish participants (262 male; 258 female) completed self-reported surveys measuring their level of physical activity, personality, and SWB in 2011-2013 (mean age = 76.23 ± 0.68) and in 2014-2016 (mean age = 79.31 ± 0.62).

Results: While all of the Big Five personality traits predicted SWB across the 3-year period in the expected direction, neither physical activity nor its joint effect with any of the personality traits was a significant predictor of subsequent SWB.

Discussion: Further research on older adults with higher variation in age, exercise level, and cultural background is needed to disentangle how physical activity and personality influence SWB.

Keywords: Lothian Birth Cohort, moderation analysis, personality traits, subjective wellbeing

1. Introduction

Due to advancing medical technologies and improved healthcare, global life expectancy has been rapidly increasing and the trend is expected to continue in the future (Geard et al., 2017; United Nations, 2019). In Scotland, the number of residents aged 65 years or above is projected to rise from 1.06 million (19% of the total population) in 2020 to 1.4 million (25% of the total population) by 2040 (National Records of Scotland, 2022). While more adults are living a longer life, the literature indicates concerns about later life subjective wellbeing (SWB), defined as "a person's cognitive and affective evaluations of his or her life" (Diener et al., 2002, p.63). In terms of cognitive evaluations, Wiggins et al. (2004) reported that adults aged 70 years and above experienced lower quality of life than their younger counterparts, and Steptoe et al. (2012) found that there was a longitudinal decline in satisfaction with life among participants aged 70 years or above. As for affective evaluations, Charles et al. (2001) reported a significant decrease in positive affect measured among older adults from their 60s to mid-80s. These findings highlighted the need for more research to investigate older adults' SWB.

Physical activity (Huang & Humphreys, 2012) and personality (Steel et al., 2008) have both been linked consistently with SWB. In a recent cross-sectional study on 349 older adults in Hong Kong and the UK, Chan et al. (2018) found that while physical activity and each of the Big Five personality traits were all correlated with SWB (measured by the mixture of satisfaction with life, positive affect, and negative affect). However, they showed that the positive relationship between physical activity and SWB was stronger among older adults with higher levels of extraversion and those with higher levels of openness to experience. Although the latter findings were novel, they were based on cross-sectional data collected on a relatively small sample, and hence causality could not be addressed. With the accessibility of data from the Lothian Birth Cohort 1936 (LBC1936) longitudinal research project (see Taylor et al., 2018), this study aimed to explore whether the interaction effects of physical activity and personality would hold longitudinally in a much larger sample of older adults in Scotland. That is, whether the strength of the interaction could predict levels of SWB in older adults assessed approximately three years later.

Previous experimental research has converged to show that older adults' wellbeing could be predicted by their level of physical activity. For example, McAuley et al.'s (2000) randomised control trial study based on 174 older adults (mean age = 65.5 years) found that physical activity significantly predicted improvement in satisfaction with life over a 6-month period. Arent et al.'s (2000) meta-analysis of 51 effect sizes from experimental research (mean age = 65 years or above) demonstrated that in comparison to participants in the control group, those in the exercise group showed significantly stronger increases in positive affect and decreases in negative affect. Similar to physical activity, personality has also been found to predict SWB in older age. For example, in 2,518 older adults (aged 51 years or above), Gilberto et al.'s (2020) longitudinal study found that all of the Big Five personality traits were associated with SWB (measured by the mixture of positive affect, negative affect, life satisfaction, and purpose in life) over a four-year period – agreeableness, conscientiousness, extraversion and openness were positive predictors, and neuroticism a negative predictor of SWB.

Although physical activity and personality were both found to predict older adults' SWB, their joint effect on SWB in later life is yet to be tested longitudinally. While physical activity has been commonly employed as a coping strategy or intervention to improve older adults' wellbeing (Andréa et al., 2010; Cordes et al., 2019), personality has been found to exert its influence more generally (Kaiseler et al., 2012; Wellenzohn et al., 2018). Taken together, personality may influence older adults' capabilities in using physical activity to improve their SWB in the long-term. Chan et al. (2018) found extraversion and openness to experience were moderators of the contemporaneous physical activity–SWB relationship. A recent qualitative study of personality and wellbeing in older badminton players provided some possible insights into their long-term joint effects (Chan & Lee, 2020). The participants who described themselves as extraverted were able to maintain stable friendship circles over the long term, and to use their badminton networks to improve mood through meeting and playing the sport. The participants who were more open to experience experienced greater satisfaction through finding different ways to appreciate their exercise, for

example, appreciation of the aesthetic aspects and through use of the sporting arena as a crucible for personality development.

Based on the foregoing, the hypotheses for this longitudinal study are as follows: 1) physical activity, extraversion, agreeableness, conscientiousness, openness to experience (measured as intellect/imagination), and neuroticism (measured as emotional stability) predict SWB measured three years later; 2) the interaction of physical activity and extraversion positively predicts SWB measured three years later; 3) the interaction of physical activity and intellect/imagination positively predicts SWB measured three years later.

2. Method

The LBC1936 study was an attempt to improve understanding of the determinants of cognitive ageing (Taylor et al., 2018). A large variety of data, including biomarker, brain imaging, genetic, lifestyle, medical, and psycho-social, were collected from community-dwelling Scottish adults born in 1936 (for sample selection procedures, please see Deary et al., 2007). Four waves of data, each roughly 3 years apart, from the

LBC1936 were available. SWB and physical activity were not measured in Wave 1 (2004-2007) and Wave 2 (2007-2010) respectively. Hence, the first two waves were not suitable for the purpose of this study. In Wave 3 (2011-2013), physical activity, personality, and SWB were measured, so the interaction term between the two predictor variables (physical activity and personality) could be created, and a baseline score of the outcome measure (SWB) could be deployed. SWB is available in Wave 4 (2014-2016), therefore, a longitudinal analysis could be conducted through regressing SWB in Wave 4 on physical activity, personality, and their interaction in Wave 3, with baseline SWB included as a covariate. For simplification, Wave 3 will be referred to as Time 1 (T1) and Wave 4 as Time 2 (T2).

2.1 Sample

Five hundred and fifty of the 697 participants from Wave 3 (T1) participated in Wave 4 (T2). Thirty participants who did not complete the SWB questionnaire at T2 were removed. The retained sample included 520 participants (262 male and 258 female).

Their mean age at T1 and T2 was 76.23 ± 0.68 and 79.31 ± 0.62 respectively. Table 1 shows their demographic characteristics.

2.2 Measures

Participants' level of physical activity was assessed on a 6-point scale: 1 = movement associated with necessary (household) chores, 2 = walking or other outdoor activities 1-2 times per week, 3 = walking or other outdoor activities several times per week, 4 = exercising 1-2 times per week to the point of perspiring and heavy breathing, 5 = exercising several times per week to the point of perspiring and heavy breathing, and 6 = keep-fit/heavy exercise or competitive sport several times per week. This single-item measure was based on an eight-year study on physical exercise in old age by Hirvensalo et al. (1998). It has been used to assess older adults' level of physical activity in various studies (Lampinen & Heikkinen, 2003; Lampinen et al., 2006).

The 50-item International Personality Item Pool (Goldberg, 1992) was used to measure personality in T1. Each personality trait was assessed via ten items (e.g., "I feel comfortable around people" for extraversion; "I make people feel at ease" for

agreeableness; “I get chores done right away” for conscientiousness; “I am relaxed most of the time” for emotional stability; and “I have a vivid imagination” for intellect/imagination). Responses were collected on a 5-point scale (from 1, *very inaccurate*, to 5, *very accurate*). Twenty-four of the 50 items were reversed coded. In relation to the Big Five Inventory (John & Srivastava, 1999) that was used in Chan et al. (2018), neuroticism and openness to experience were equivalent to emotional stability and intellect/imagination respectively. Zheng et al.’s (2008) study reported moderate to strong convergent correlations between each of the five traits measured by the 50-item International Personality Item Pool and by the Big Five Inventory: .72 for extraversion, .47 for agreeableness, .67 for conscientiousness, -.70 for emotional stability, and .59 for intellect/imagination. All these correlations were statistically significant at the $p < 0.01$ level.

Tennant et al.’s (2007) Warwick-Edinburgh Mental Well-being Scale (WEMWBS) was used to measure SWB in T1 and T2. The 14-item scale covered *positive affect* (e.g., “I’ve been feeling relaxed), *satisfying interpersonal relationships* (e.g., “I’ve been feeling close to other people”) and *positive functioning* (e.g., “I’ve

been able to make up my own mind about things"). All items were positively worded and rated on a 5-point scale (from 1, *none of the time*, to 5, *all of the time*). Tennant et al. (2007) showed, through confirmatory factor analysis, that WEMWBS assesses a single construct.

[Insert Table 1]

2.3 Analysis Strategy

Data were analysed with SPSS 22.0. With SWB measured in T2 as the outcome variable, five separate 4-step hierarchical multiple regression analyses were conducted, one for each personality trait. SWB measured at T1 was entered as a control in step 1. The four demographic and health variables: age, gender, highest level of qualification, and number of diseases and health problems at T1 were entered as covariates in step 2. Number of diseases and health problems was adopted to replace the "yes/no" measure of whether the participants had any longstanding illness or disability in Chan et al. (2018). Physical activity and personality trait at T1 were entered as predictors in step 3. Five interaction terms representing the joint effect of physical activity and each of the five personality traits at T1 were created and entered in step 4.

3. Results

3.1 Longitudinal Findings

3.1.1 Descriptive Statistics

The mean, standard deviation, and inter-correlations of the variables assessed in the longitudinal analysis are shown in Table 2. Physical activity and all five of the personality traits at T1 were positively related to SWB at both time-points.

[Insert Table 2]

3.1.2 Moderation Analysis

The results of the moderation analysis are shown in Tables 3-7. In step 1, SWB at T1 explained a substantial proportion of variance (58%) in SWB at T2, showing that SWB was relatively stable over the three years. In step 2, the four demographic/health variables only accounted for 1% of the variance in SWB at T2. None of them contributed significantly. In step 3, the addition of physical activity and each of the personality traits explained 0.5% to 1.2% of variance in SWB at T2. Physical activity itself did not predict subsequent SWB. All five of the personality traits had a positive

main effect on SWB at T2, with extraversion being the strongest predictor. In step 4, the five physical activity × personality interaction terms were all non-significant.

[Insert Table 3]

[Insert Table 4]

[Insert Table 5]

[Insert Table 6]

[Insert Table 7]

4. Discussion

This study is the first to assess the interaction of physical activity and personality on change in SWB over time. Initial correlation analyses showed that physical activity and all of the personality traits are related to SWB both concurrently and longitudinally in the expected direction. However, in the regression analysis, after the baseline and demographic variables were controlled, physical activity did not predict subsequent SWB measured three years later. The five personality traits remained significant predictors of SWB, supporting previous research reporting relationships between older

adults' personality traits and SWB (Gilberto et al., 2020). None of the five interactions tested between physical activity and personality had a significant impact on change in SWB over a three-year period, meaning that neither extraversion nor openness enhanced physical activity's long-term effect on SWB.

A number of differences between Chan et al. (2018) and this study may help to explain the divergent findings. First, participants in this study were comparatively physically inactive - less than 10% of them were playing sports or exercising to the point of perspiring and heavily breathing more than twice a week, and around 80% of them did not participate in any kinds of weekly exercises to the point of perspiring and heavily breathing at all. Hence, the low variation in physical activity in this sample may be limiting its correlation with SWB.

Second, participants in this study were much older. Many of the previous aging studies (e.g., McAuley et al., 2000; Potocnik & Sonnentag, 2013) that have reported a long-term positive relationship between physical activity and SWB have been conducted on slightly younger participants. It is also noteworthy that the zero-order correlation test in this study showed that physical activity at T1 was significantly

correlated to SWB at T2, and yet in the adjusted models, the former did not predict the latter. Taken together, the older age of the participants may account for the absence of a significant relationship between physical activity and SWB in this study.

Finally, according to Jayawickreme et al. (2012), the combination of high positive affect and low negative affect contributes to greater subjective experience of wellbeing than either alone. Whereas Chan et al.'s (2018) study sampled both positive and negative emotions, the wellbeing inventory used in the LBC1936 failed to address negative affect. Stathi et al. (2002) found that regular participation in physical activity allowed older adults to feel less alone, whereas Allen et al. (2014) reported that sports participants who were extraverted and open to experiences showed a lower intensity of negative emotions. Thus it is possible that the interaction effects of physical activity and personality act primarily on reducing negative affect, which we were unable to test in the LBC1936.

Whereas personality did not moderate the effects of physical activity in this study, it did predict SWB across the three-year period: extraversion, conscientiousness, agreeableness, emotional stability, and intellect/imagination were all associated with

higher levels of subsequent SWB. Therefore wellbeing practitioners may consider implementing personality development (Martin et al. 2014) as a strategy to improve older adults' wellbeing, especially in light of growing evidence that personality changes can occur in later life (Leszko et al., 2016; Mueller et al., 2016; Schwaba & Bleidorn, 2019).

Two strengths of this study compared to Chan et al. (2018) are noteworthy. First, the sample size was 49% larger. Second, participant recruitment and data collection for the relevant questionnaires were conducted via mailing rather than online methods, thus overcoming selection bias related to internet use.

In addition to the unipolar measure of SWB, the assessment of physical activity was also a limitation of this study. The single question measure used in this study did not take into account the duration of the activity and only asked participants to indicate between "1-2 times" and "several times". In other words, exercises which lasted less than 5 minutes were still counted and a difference between 3 times a week and 6 times a week was not assessed. Furthermore, all of the participants in this study were born in 1936 and based in Scotland (Deary et al., 2012; Taylor et al., 2018), which limits the

generalisability of the findings.

Overall, based on extensive pre-existing data from the LBC1936, this study found personality but not physical activity level predicts SWB in older adults in their 70s. Unlike previous research on slightly younger older adults, the two variables did not significantly interact. Further research on interaction effects between physical activity and personality in the different epochs of later life are needed. To go one step further, future research could explore the three-way interactions between physical activity, personality, and age. That is, whether the joint effect of physical activity and personality on wellbeing will be experienced differently between elderly adults classified in the healthy ageing literature (see Lee et al., 2018) as youngest-old, middle-old, and oldest-old.

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Reference

Allen, M. S., Greenlees, I., & Jones, M. V. (2014). Personality, counterfactual thinking, and negative emotional reactivity. *Psychology of Sport and Exercise*, 15(2), 147-154. https://doi.org/10.1016/j.psychsport.2013.10.011

Andréa, F. D., Lanuez, F. V., Machado, A. N., & Jacob Filho, W. (2010). Physical activity and stress coping in the elderly. *Einstein (São Paulo)*, *8*(4), 419-422. https://doi.org/10.1590/s1679-45082010ao1549

Arent, S. M., Landers, D. M., & Etnier, J. L. (2000). The effects of exercise on mood in older adults: A meta-analytic review. *Journal of Aging and Physical Activity*, *8*(4), 407-430. https://doi.org/10.1123/japa.8.4.407

Chan, B. C. L., & Lee, B. (2020). Wellbeing and personality through sports: A qualitative study of older badminton players in two cultures. *Qualitative Research in Sport, Exercise and Health*, *12*(3), 350-362. https://doi.org/10.1080/2159676X.2019.1606850

Chan, B. C. L., Luciano, M., & Lee, B. (2018). Interaction of physical activity and personality in the subjective wellbeing of older adults in Hong Kong and the United Kingdom. Behavioral Sciences, *8*(8), 71. https://doi.org/10.3390/bs8080071

Charles, S. T., Reynolds, C. A., & Gatz, M. (2001). Age-related differences and change in positive and negative affect over 23 years. *Journal of Personality*

and Social Psychology, 80(1), 136-151. https://doi.org/10.1037/0022-3514.80.1.136

Cordes, T., Bischoff, L. L., Schoene, D., Schott, N., Voelcker-Rehage, C., Meixner, C., Appelles, L., Bebenek, M., Berwinkel, A., Hildebrand, C., Jöllenbeck, T., Johnen, B., Kemmler, W., Klotzbier, T., Korbus, H., Rudisch, J., Vogt, L., Weigelt, M., … Jöllenbeck, T. (2019). A multicomponent exercise intervention to improve physical functioning, cognition and psychosocial well-being in elderly nursing home residents: A study protocol of a randomized controlled trial in the PROCARE (prevention and occupational health in long-term care) project. *BMC Geriatrics*, *19*(1), 369. https://doi.org/10.1186/s12877-019-1386-6

Deary, I. J., Gow, A. J., Pattie, A., & Starr, J. M. (2012). Cohort profile: The Lothian Birth Cohorts of 1921 and 1936. *International Journal of Epidemiology*, *41*(6), 1576-1584. https://doi.org/10.1093/ije/dyr197

Deary, I. J., Gow, A. J., Taylor, M. D., Corley, J., Brett, C., Wilson, V., ... & Starr, J. M. (2007). The Lothian Birth Cohort 1936: A study to examine influences on cognitive ageing from age 11 to age 70 and beyond. *BMC geriatrics, 7*, 28. http://dx.doi.org/10.1186/1471-2318-7-28

Diener, E., Lucas, R. E., & Oishi, S. (2002). Sujective well-being: The science of happiness and life satisfaction. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of Positive Psychology* (pp. 463–73). Oxford University Press.

Geard, D., Reaburn, P. R., Rebar, A. L., & Dionigi, R. A. (2017). Masters athletes: Exemplars of successful aging?. *Journal of Aging and Physical Activity*, *25*(3), 490-500. https://doi.org/10.1123/japa.2016-0050

Gilberto, J. M., Davenport, M. K., & Beier, M. E. (2020). Personality, Health, Wealth, and Subjective Well-Being: Testing a Integrative Model with Retired and Working Older Adults. *Journal of Research in Personality*, 103959. https://doi.org/10.1016/j.jrp.2020.103959

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment*, *4*(1), 26-42. https://doi.org/10.1037/1040-3590.4.1.26

Hirvensalo, M., Lampinen, P., & Rantanen, T. (1998). Physical exercise in old age: An eight-year follow-up study on involvement, motives, and obstacles among persons age 65-84. *Journal of Aging and Physical Activity*, 6(2), 157-168. https://doi.org/10.1123/japa.6.2.157

Huang, H., & Humphreys, B. R. (2012). Sports participation and happiness: Evidence from US microdata. *Journal of Economic Psychology*, *33*(4), 776-793. https://doi.org/10.1016/j.joep.2012.02.007

Jayawickreme, E., Forgeard, M. J., & Seligman, M. E. (2012). The engine of well-being. *Review of General Psychology*, 16(4), 327. https://doi.org/10.1037/a0027990

Kaiseler, M., Polman, R. C., & Nicholls, A. R. (2012). Effects of the Big Five personality dimensions on appraisal coping, and coping effectiveness in sport.

European Journal of Sport Science, 12(1), 62-72. https://doi.org/10.1080/17461391.2010.551410

Lampinen, P., & Heikkinen, E. (2003). Reduced mobility and physical activity as predictors of depressive symptoms among community-dwelling older adults: An eight-year follow-up study. *Aging Clinical and Experimental Research*, 15(3), 205-211. https://doi.org/10.1007/BF03324501

Lampinen, P., Heikkinen, R. L., Kauppinen, M., & Heikkinen, E. (2006). Activity as a predictor of mental well-being among older adults. *Aging and Mental Health*, 10(5), 454-466. https://doi.org/10.1080/13607860600640962

Leszko, M., Elleman, L. G., Bastarache, E. D., Graham, E. K., & Mroczek, D. K. (2016). Future directions in the study of personality in adulthood and older age. *Gerontology*, 62(2), 210-215. https://doi.org/10.1159/000434720

Martin, L. S., Oades, L. G., & Caputi, P. (2014). A step-wise process of intentional personality change coaching. *International Coaching Psychology Review*, 9(2), 181–195.

McAuley, E., Blissmer, B., Marquez, D. X., Jerome, G. J., Kramer, A. F., & Katula, J. (2000). Social relations, physical activity, and well-being in older adults. *Preventive Medicine : An International Journal Devoted to Practice and Theory*, 31(5), 608-617. https://doi.org/10.1006/pmed.2000.0740

Mueller, S., Wagner, J., Drewelies, J., Duezel, S., Eibich, P., Specht, J., Demuth, I., Steinhagen-Thiessen, E., Wagner, G., & Gerstorf, D. (2016). Personality development in old age relates to physical health and cognitive performance:

Evidence from the Berlin Aging Study II. *Journal of Research in Personality*, 65, 94-108. https://doi.org/10.1016/j.jrp.2016.08.007

National Records of Scotland. (2022, January 12). *Projected Population of Scotland (2020-based)*. https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections/population-projections-scotland/2020-based/2020-based-unrevised

Schwaba, T., & Bleidorn, W. (2019). Personality trait development across the transition to retirement. *Journal of Personality and Social Psychology*, *116*(4), 651–665. https://doi.org/10.1037/pspp0000179

Stathi, A., Fox, K. R., & McKenna, J. (2002). Physical activity and dimensions of subjective well-being in older adults. *Journal of Aging and Physical Activity*, *10*(1), 76-92. https://doi.org/10.1123/japa.10.1.76

Steel, P., Schmidt, J., & Shultz, J. (2008). Refining the relationship between personality and subjective well-being. *Psychological Bulletin*, *134*(1), 138-161. https://doi.org/10.1037/0033-2909.134.1.138

Steptoe A., Demakakos P., De Oliveira C. (2012). The psychological well-being, health and functioning of older people in England. In J. Banks, J. Nazroo, & A. Steptoe (Eds.), *The dynamics of ageing: Evidence from the English Longitudinal Study of Ageing 2002–10 (Wave 5)* (pp. 98–182). Institute for Fiscal Studies.

Taylor, A. M., Pattie, A., & Deary, I. J. (2018). Cohort profile update: The Lothian Birth Cohorts of 1921 and 1936. *International Journal of Epidemiology*, *47*(4), 1042–1060. https://doi.org/10.1093/ije/dyy022

Tennant, R ., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The Warwick-Edinburgh mental well-being scale (WEMWBS): Development and UK validation. *Health and Quality of Life Outcomes*, *5*(1), 63. https://doi.org/10.1186/1477-7525-5-63

United Nations. (2019). *World Population Prospects 2019*. Retrieved December 31, 2019, from https://population.un.org/wpp/

Wellenzohn, S., Proyer, R. T., & Ruch, W. (2018). Who benefits from humor-based positive psychology interventions? The moderating effects of personality traits and sense of humor. *Frontiers in Psychology*, *9*, 821. https://doi.org/10.3389/fpsyg.2018.00821

Wiggins, R. D., Higgs, P. F. D., Hyde, M., & Blane, D. B. (2004). Quality of life in the third age: Key predictors of the CASP-19 measure. *Ageing and Society*, *24*(5), 693–708. https://doi.org/10.1017/S0144686X04002284

Zheng, L., Goldberg, L. R., Zheng, Y., Zhao, Y., Tang, Y., & Liu, L. (2008). Reliability and concurrent validation of the IPIP Big-Five factor markers in China: Consistencies in factor structure between Internet-obtained heterosexual and homosexual samples. *Personality and Individual Differences, 45*(7), 649-654. https://doi.org/10.1016/j.paid.2008.07.009

Table 1

Demographic data for participants

	Frequency (*N* = 520)
Gender	
Male	262 (50.4%)
Female	258 (49.6%)
Highest level of qualification	
No qualification	75 (14.4%)
O-level or equivalent	187 (36.0%)
A-level or equivalent	83 (16%)
Semi-professional or professional qualifications	71 (13.7%)
Degree	103 (19.8%)
Unspecified	1 (0.2%)
Number of diseases and health problems	
0	13 (2.5%)
1	52 (10.0%)
2	97 (18.7%)
3	122 (21.5%)
4	64 (12.3%)
5	64 (12.3%)
6	34 (6.5%)
7	15 (2.9%)
8 or more	8 (1.6%)
Unspecified	3 (0.6%)

Table 2

Mean, standard deviation, and inter-correlations for study variables for longitudinal analysis

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Baseline SWB	38.05	7.22											
2. Age	76.23	0.68	-0.07										
3. Gender	1.50	0.50	0.11*	-0.03									
4. Highest level of qualification	1.88	1.36	0.03	-0.06	-0.09								
5. Number of diseases and health problems	3.40	1.70	-0.11*	0.10*	0.07	-0.05							
6. Physical activity	2.90	1.12	0.10*	-0.11*	-0.04	0.15**	-0.19						
7. Extraversion	21.80	7.26	0.38*	-0.01	0.11*	0.11*	-0.04	0.07					
8. Agreeableness	30.85	5.40	0.44*	0.02	0.34**	-0.04	0.03	-0.05	0.38**				
9. Conscientiousness	27.86	6.14	0.38**	-0.06	0.05	0.04	-0.17**	0.09*	0.14**	0.30**			
10. Emotional stability	25.58	7.16	0.50**	0.05	-0.06	0.14**	-0.11*	0.06	0.26**	0.24**	0.29**		
11. Intellect/ Imagination	24.08	5.89	0.30**	-0.08	0.03	0.37**	0.03	0.09*	0.45**	0.35**	0.26**	0.17**	
12. SWB T2	37.93	8.30	0.76**	-0.02	0.12**	0.04	-0.14**	0.11*	0.39**	0.40**	0.38**	0.46**	0.29**

Note. $N = 520$. Variables 1-11 were measured at T1. For gender 1 = male, 2 = female. For highest level of qualification 0 = No qualification, 1 = O-level or equivalent, 2 = A-level or equivalent, 3 = Semi-professional or professional qualifications, 4 = degree. *$p < 0.05$, ** $p < 0.01$.

Table 3

Interaction analysis of physical activity and extraversion

		B	***SE***	***B***
Step 1	Baseline SWB	6.27	0.24	0.76***
Step 2	Age	0.41	0.24	0.05
	Gender	0.35	0.24	0.04
	Highest level of qualification	0.13	0.24	0.02
	Number of diseases and health problems	-0.49	0.26	-0.06
Step 3	Physical activity	0.25	0.24	0.03
	Extraversion	0.94	0.26	0.11***
Step 4	Interaction (Physical activity x Extraversion)	-0.16	0.26	-0.02

Note. $N = 520$. *B* = unstandardised beta. *SE* = standard error. β = standardised beta. ***$p < 0.001$.

Table 4

Interaction analysis of physical activity and agreeableness

		B	***SE***	***B***
Step 1	Baseline SWB	6.27	0.24	0.76***
Step 2	Age	0.41	0.24	0.05
	Gender	0.35	0.24	0.04
	Highest level of qualification	0.13	0.24	0.02
	Number of diseases and health problems	-0.49	0.26	-0.06
Step 3	Physical activity	0.33	0.25	0.04
	Agreeableness	0.66	0.29	0.08*
Step 4	Interaction (Physical activity x Agreeableness)	-0.17	0.23	-0.02

Note. $N = 520$. B = unstandardised beta. SE = standard error. β = standardised beta. *$p < 0.05$, ***$p < 0.001$.

Table 5

Interaction analysis of physical activity and conscientiousness

		B	*SE*	*B*
Step 1	Baseline SWB	6.27	0.24	0.76***
Step 2	Age	0.41	0.24	0.05
	Gender	0.35	0.24	0.04
	Highest level of qualification	0.13	0.24	0.02
	Number of diseases and health problems	-0.49	0.26	-0.06
Step 3	Physical activity	0.26	0.24	0.03
	Conscientiousness	0.82	0.26	0.10**
Step 4	Interaction (Physical activity x Conscientiousness)	0.25	0.23	0.03

Note. $N = 520$. *B* = unstandardised beta. *SE* = standard error. β = standardised beta. $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 6

Interaction analysis of physical activity and emotional stability

		B	***SE***	***B***
Step 1	Baseline SWB	6.27	0.24	0.76***
Step 2	Age	0.41	0.24	0.05
	Gender	0.35	0.24	0.04
	Highest level of qualification	0.13	0.24	0.02
	Number of diseases and health problems	-0.49	0.26	-0.06
Step 3	Physical activity	0.30	0.24	0.04
	Emotional Stability	0.85	0.28	0.10**
Step 4	Interaction (Physical activity x Emotional Stability)	-0.09	0.23	-0.01

Note. $N = 520$. B = unstandardised beta. SE = standard error. β = standardised beta. **$p < 0.01$, ***$p < 0.001$.

Table 7

Interaction analysis of physical activity and intellect/imagination

		B	***SE***	***B***
Step 1	Baseline SWB	6.27	0.24	0.76***
Step 2	Age	0.41	0.24	0.05
	Gender	0.35	0.24	0.04
	Highest level of qualification	0.13	0.24	0.02
	Number of diseases and health problems	-0.49	0.26	-0.06
Step 3	Physical activity	0.28	0.25	0.03
	Intellect/Imagination	0.61	0.27	0.08*
Step 4	Interaction (Physical activity x Intellect/Imagination)	0.28	0.25	0.03

Note. $N = 520$. *B* = unstandardised beta. *SE* = standard error. β = standardised beta. *$p < 0.05$, ***$p < 0.001$.